SD Department of Environment & Natural Resources
Watershed Protection Program
Total Maximum Daily Load

McCook Lake Watershed, Union County South Dakota
February, 1999

This TMDL was developed in accordance with Section 303(d) of the federal Clean Water Act and guidance developed by the US Environmental Protection Agency. The 1996 303(d) Waterbody List identified McCook Lake as impaired. A TMDL had not been completed for McCook Lake before the 1998 303(d) list was finaled; therefore, McCook Lake was "rolled over" into the 1998 list. During this time, the Section 319 Implementation Project was initiated and completed. This TMDL addresses the water quality impairment of accumulated sediment for McCook Lake prior to the implementation project.

TMDL Summary for Accumulated Sediment

Waterbody Name	**McCook Lake**
Hydrologic Unit Code (HUC)	10170101
TMDL Pollutant	**Accumulated Sediment**
Water Quality Target	Removal of 1,700,000 cubic yards of sediment
TMDL Goal	Increase average lake depth by 4.5 feet over 183 surface acres
303(d) Status	Roll over from 1996 303(d) Waterbody List into 1998 303(d) Waterbody List
Impaired Beneficial Uses	Warmwater permanent fish life propagation, immersion recreation, limited contact recreation.
Reference Document	Diagnostic/Feasibility Study Report McCook Lake Union County, South Dakota, 1990

I. Executive Summary:

- ***Waterbody Description and Impairments***

McCook Lake is an oxbow lake located in extreme southeastern South Dakota, which was formed by an old cutoff of the Missouri River. The lake is located in Union County, Big Sioux Township, approximately one mile west-northwest of North Sioux City, South Dakota (Figure 1). The lake has a surface area of approximately 183 acres and a watershed of approximately 500 acres. Excess sediment resulting in loss of water depth and reduced recreational uses are the major concerns with McCook Lake. The average depth of the lake is 4 feet and ranges from 2 to 6 feet. Recreational uses that are impaired include fishing,

swimming, and boating. Sediment is the pollutant in this case. Sediment depth varies from approximately 2 feet to in excess of 10 feet.

- ***Stakeholder Description***

McCook Lake Association
McCook Lake Izaak Walton League
North Sioux City, South Dakota
Union County, South Dakota
SD Department of Environment and Natural Resources
SD Department of Game, Fish and Parks

- ***Intent to Submit as a Clean Water Act Section 303(d) TMDL***

In accordance with Section 303(d) of the Clean Water Act, the South Dakota Department of Environment and Natural Resources submits for EPA, Region VIII review and approval, the sediment total maximum daily load (TMDL) for McCook Lake as provided in this summary and attached documents. The TMDL was established to meet designated use classifications for McCook Lake with consideration of seasonal variation and a margin of safety. The designated use classifications that will be protected through implementation of the TMDL by removal of the lake sediment include: warmwater permanent fish life propagation, immersion recreation, limited contact recreation.

II. Problem Characterization:

- ***Maps***

A map of McCook Lake, its watershed, and location in South Dakota is included as Figure 1.

- ***Waters Covered by TMDL***

McCook Lake is the benefactor of this TMDL.

- ***Rationale for Geographic Coverage***

Soils surrounding the lake are alluvial bottomland soils of the Albanton-Haynie-Onawa association that are deep, poorly to well drained, level to nearly level, clayey and silty soils. Land-use on the outer shoreline of the oxbow lake is primarily residential with permanent year-round homes. All homes at McCook Lake are connected to a central sewer system. A portion of the inner oxbow land has been used as a disposal area to accommodate dredging activities as part of a lake restoration project. Additional land-use in the immediate area includes farmland and pastureland.

- ***Pollutant(s) of Concern***

Accumulated sediment

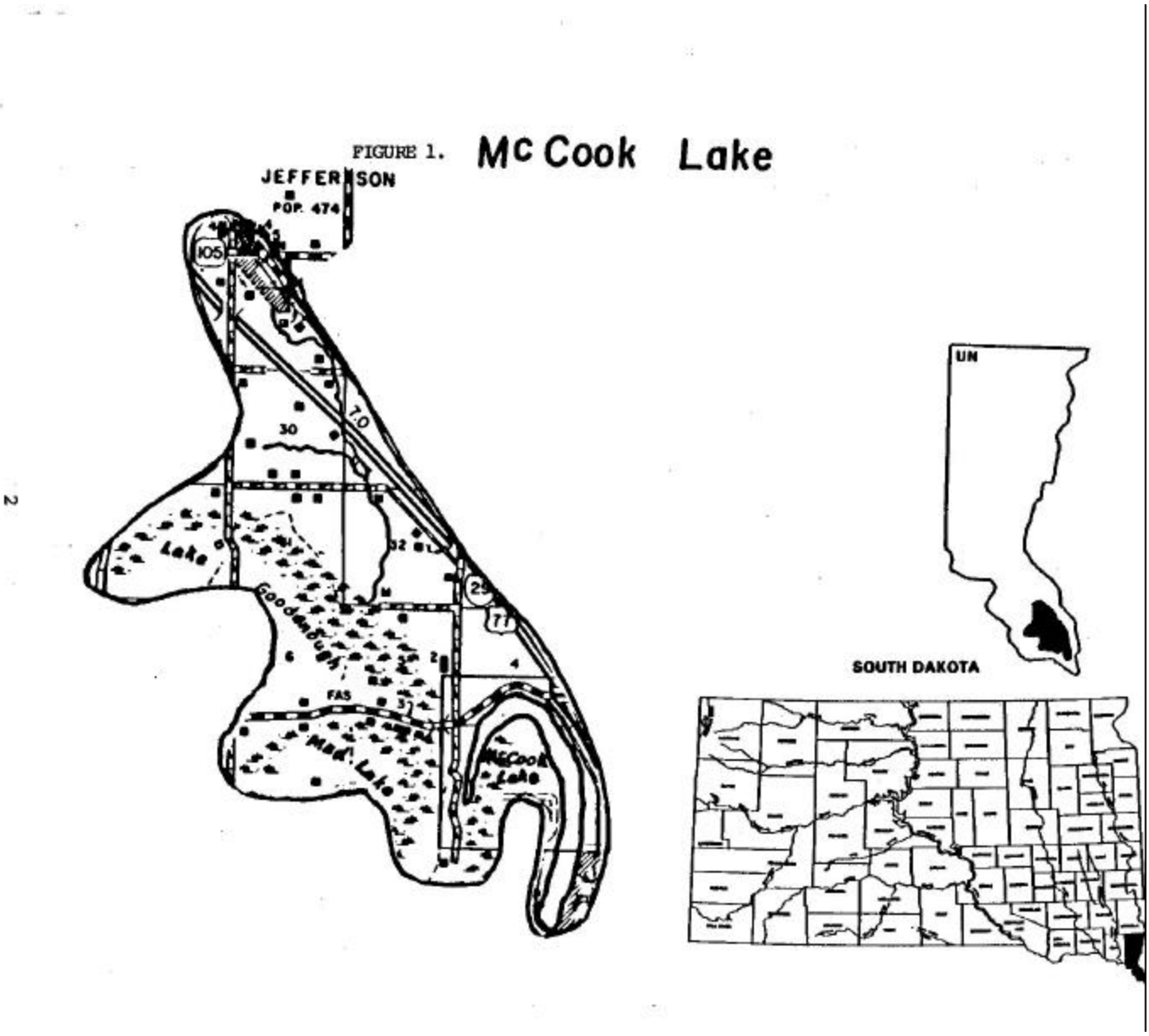

Figure 1. McCook Lake Watershed

- ***Use Impairments or Threats***

The beneficial uses of warmwater fish life propagation, immersion recreation and limited contact recreation were impaired by the accumulated sediment due to shallow water depths and related water quality. Water depths ranged from 2 - 6 feet, with the greatest percentage of the lake between 2 - 4 feet deep. These depths, along with related increased temperatures and dense aquatic vegetation were not conducive to boating, swimming and sport fishing. The lake mimicked a prairie slough more than a lake.

The restoration activity of dredging was begun in 1991 following local concerns of loss of depth and decrease of recreational opportunities. From 1991 through 1994, the restoration was funded with assistance of state and federal funds. From 1995 to the present, the restoration activity has been funded solely with local dollars. A testament to the concern about use impairment is the high level of local support to fund and manage the project for the last several years.

- ***Probable Sources***

There are no tributaries flowing into or out of the lake basin; the level of the lake is controlled by groundwater and is directly connected to the Missouri River by the existing water table.

During the 1930's, locks were constructed at each end of the lake as a part of the WPA program. The locks were intended to allow Missouri River water to flow into the lake during periods of high flow to help stabilize the lake level. However, the Missouri River floods of the 1950's deposited large amounts of silt in McCook Lake. Since the construction of the main stem dams on the Missouri River, high flows on the river have been eliminated, and together with river bed degradation, has rendered the locks ineffective. Local residents have attempted to maintain the lake level by pumping from the Missouri River since 1970. A few years later, a well was added to supplement the water in the lake.

Prior to restoration, begun during 1991, the mean depth of the lake was 4 feet and the lake volume was approximately 732 acre-feet. The total soft sediment in the lake was estimated to be approximately 1,700,000 cubic yards. The soft sediment consisted of fine clay particles, with fine sand lying below the clay. A sediment survey conducted in 1989 revealed that the fine clay varied in thickness from 1.8 feet to over 10 feet with an average thickness of 4.5 feet. Nearly half the shoreline was covered with cattails and bulrush. *Potamogeton sp.* was a common floating and submerged aquatic plant.

Local project personnel were contacted concerning storm drains as sources of sediment. They confirmed that all storm drains filter through grassed waterways. In addition, all storm drains have debris baskets in place and are checked and cleaned periodically. According to local project personnel, little, if any, sediment reached the lake through storm drains. Bank erosion, road construction, and runoff from lawns and gardens were not significant sources of sediment according to local project personnel.

III. TMDL Endpoint:

- ***Description***

The TMDL for this waterbody was to restore beneficial uses by increasing average lake depth by an estimated 4.5 feet over an area of 183 surface acres.

This goal would be accomplished by the removal of 1,700,000 cubic yards of accumulated inlake sediment. The goal was based on the estimated total amount of accumulated sediment in the lake.

- ***Endpoint Link to Surface Water Quality Standards***

Removal of lake sediment will have a dramatic effect on designated beneficial uses and should lead to better water quality. The dredging has deepened the lake. This alone will improve immersion and limited contact recreational uses. It is also expected that dissolved oxygen levels will increase and overall water temperatures will decrease, thereby enhancing the lake's fishery. Water clarity is also expected to increase as shallow vegetation will be eliminated and nutrient-bound sediment (primarily phosphorus) removed.

IV. TMDL Analysis and Development:

- ***Data Sources***

Data sources include the 1990 Diagnostic/Feasibility Study Report for McCook Lake, additional reports found in Section IV of this document, and reports from the local project coordinator recording amounts of sediment removed.

- ***Analysis Techniques or Models***

During the Diagnostic/Feasibility study, water quality samples were collected according to Quality Control/Quality Assurance EPA approved methods. Laboratory analyses were conducted by the South Dakota State Health Laboratory in Pierre, South Dakota. Water quality data was loaded onto computer files and analyzed for trends. A minimum, mean, and maximum were calculated for each of the parameters measured.

Sediment surveys were conducted using the rebar technique of sediment probing. Elutriate samples of the sediment were collected and analyzed by the U.S. Army Corps of Engineers Laboratory in Omaha, Nebraska.

Amounts of sediment removed by dredging were calculated by readings of the nuclear density meter on board the dredge during operation.

- ***Seasonality***

Seasonality is not a factor as there are no seasonally-related loadings to the lake and the sediment removal goal has been met.

- ***Margin of Safety***

The total amount of sediment in McCook Lake was larger than previously estimated. The amount of sediment actually removed from McCook Lake from 1991 to the present (1998) totals 2,248,000 cubic yards. This amount represents nearly 132 percent of the TMDL goal to remove 1,700,000 cubic yards.

Additional sediment removal is expected to continue through the year 2000. With insignificant or zero future sediment deposition anticipated from the Missouri River or the McCook Lake watershed, it is expected that the implementation activity will result in permanent removal of the inlake sediment that was causing beneficial use impairment in McCook Lake.

V. Allocation of TMDL Loads or Responsibilities:

- ***Wasteload Allocation***

There are no point sources of pollutants of concern in the watershed. Therefore, the "wasteload allocation" component of this TMDL is considered a zero value. The TMDL is considered wholly included within the "load allocation" component.

- ***Load Allocation***

The load allocation for accumulated sediment in McCook Lake is 100 percent historic deposition by the Missouri River prior to the construction of the Missouri River reservoir system. No significant sources of sediment exist now that the potential for high flows received from the Missouri River has been eliminated.

- ***Allocation of Responsibility***

In 1990, the Department of Environment and Natural Resources produced a report of a Diagnostic/Feasibility study of McCook Lake conducted from June 1988, through September 1989. Based upon information available at that time, a recommendation was made to restore McCook Lake using a two-step approach beginning with selective dredging in areas with maximum sediment accumulation and establishment of boating restrictions. The second phase recommended was continued dredging, as funding permitted, in areas with less accumulated sediment.

The McCook Lake Izaak Walton League was able to purchase a large dredge from the state of South Dakota and elected to conduct whole lake dredging as a restoration alternative. State funding assisted the project from 1991 through 1994. Private funds contributed by the McCook Lake Izaak Walton League were used to fund the project from 1995 to the present and will be used to fund the project through the year 2000. Information supplied by the local sponsors indicates the yearly totals in cubic yards of sediment removed from McCook Lake as follows:

Year	Dredged Material (cubic yards)
1991	38,000
1992	250,000
1993	240,000
1994	330,000

1995	340,000
1996	375,000
1997	325,000
1998	350,000
TOTAL	**2,248,000**

According to local project sponsors, dredging will continue for approximately two more years, through the autumn of 2000, as there is more sediment in the lake than was previously identified.

Average depth of the lake has increased from 4.5 feet to 11.0 feet with some areas reaching deeps up to 15 feet (Al Parvu, project manager, pers. comm.).

VI. Schedule of Implementation:

The TMDL has been implemented, therefore, a schedule is not included.

VII. Post-Implementation Monitoring:

After the year 2000, it is recommended that the McCook Lake Izaak Walton League participate in the South Dakota Citizen's Monitoring Program to monitor the effectiveness of the TMDL. It is also proposed that the department continue to monitor McCook Lake every two to four years as part of the Statewide Lakes Assessment Program.

VIII. Public Participation:

- ***Summary of Public Review***

The Diagnostic/Feasibility study was conducted from June 1988 through September, 1989 and involved the following entities: South Dakota Department of Environment and Natural Resources, town of North Sioux City, local residents, and the McCook Lake chapter of the Izaak Walton League. Initial implementation funding was secured through a section 314 EPA Clean Lakes grant and supplemented with funds awarded by the Board of Water and Natural Resources of the South Dakota Department of Environment and Natural Resources.

The McCook Lake Izaak Walton League held several scoping meetings prior to and during the assessment and implementation phases of the project.

Pubic participation in the McCook Lake project are also documented in the following activities:

North Sioux City South Dakota Common Council. McCook Lake Restoration Project. 1980. Document contained a diagnostic/feasibility study and in in-depth study of groundwater in the McCook Lake area.

Buell, Winter, Mousel and Associates, Sioux City, Iowa. Preliminary engineering report of proposed dredging work at McCook Lake. 1980. Document listed plans for dredging the lake.

South Dakota Department of Environment and Natural Resources. Ordinary High Water Mark Investigations for McCook Lake. 1981. OHWM set at 1090.7 feet msl and OHWL at 1090.3 feet msl.

South Dakota Department of Environment and Natural Resources. South Dakota Lakes Survey. 1981. Document presented geographical, physio-chemical, biotic, edaphic, and other descriptive information on McCook Lake.

Union Conservation District. Soil and Water Conservation Plan. United States Department of Agriculture, Soil Conservation Service, 1982. Document included soil loss estimated for selected plots near McCook Lake.

U. S. Army Corps of Engineers. Feasibility Study for Water Level Maintenance at McCook Lake. Omaha District, South Dakota. 1983. Proposed that dredging of the lake to the sand bottom will result in more rapid equilibration of the lake and ground water levels.

Electronic media	***Mailings***	***Public Comments Received***
December, 1998 Project Summary added to department website **March,1999** TMDL Summary advertised on department website	**Interested Parties** March 10, 1999 **Stakeholders** March 10, 1999 **Daily Newspaper** March 8, 1999	Comments received during project meetings and review of the draft report and findings were considered

IX. Supporting Development Document(s) (attached):

Diagnostic/Feasibility Study Report McCook Lake Union County, South Dakota. March, 1990. South Dakota Clean Lakes Program, Division of Water Resources Management, South Dakota Department of Water and Natural Resources. 25pp.